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U.S. Department of Energy  
Before the  
Subcommittee on Energy  
Committee on Science  
U.S. House of Representatives

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Mr. Chairman and members of the Subcommittee, I am pleased to present the Department of Energy's fiscal year 2002 budget request for the Office of Nuclear Energy, Science and Technology (NE). We are proposing a \$223 million investment during fiscal year 2002 to conduct vital nuclear research and development programs; to enhance the Nation's science, technology and education infrastructure; and to manage NE's Federal nuclear facilities and materials. We believe that, by supporting nuclear energy technology, the U.S. can achieve a balanced and sustainable energy supply, reestablish its international leadership in nuclear technology development, promote national security, and attain environmental goals.

The Administration is currently developing a new national energy strategy. Secretary of Energy Abraham, speaking in March to a National Energy Summit, stated the essence of the new review:

Our national energy policy will stress the need to diversify America's energy supply. It will be founded on the understanding that diversity of supply means security of supply .... and that a broad mix of supply options -- from coal to windmills, nuclear to natural gas -- will help protect consumers against price spikes and supply disruptions.

The review will provide the guidelines of a new, comprehensive strategy to deal with our Nation's near-term energy challenges and put the technical ingenuity of our universities, laboratories, and industry to work to assure that we have long-term sources of energy to power the United States in the longer-term future.

## **THE REVITALIZATION OF THE NUCLEAR POWER OPTION**

The last few years have truly been an exceptional period for nuclear power in the United States. With demand for electricity at record highs, the Nation's nuclear power plants have been producing a record amount of power -- up 3.7 percent to 755 billion kilowatt-hours last year. The nuclear share of electricity generation in 2000 (almost 23 percent of the total) also set a record. U.S. nuclear power plants exceeded peak operating performance records set over the last few years, increasing plant capacity to nearly 90 percent. Meanwhile, the costs of producing electricity from nuclear power hit a record low in 2000, leading nuclear power plants to surpass coal-fired plants -- for the first time in more than a decade -- as the leader in low-cost electricity production.

In addition, the industry is aggressively and successfully moving forward with plant relicensing to extend operation of the existing fleet of plants for another twenty years. Last spring, the Nuclear Regulatory Commission (NRC) approved license extensions authorizing five nuclear units at two nuclear sites (Calvert Cliffs in Maryland and Oconee in South Carolina) to operate another 20 years. NRC is presently reviewing five other applications at three nuclear sites and the applications for thirty other units are pending. Today, industry and government alike expect that nearly all of the 103 U.S. nuclear plants will extend their licenses another 20 years.

Furthermore, the consolidation that has been taking place in the utility industry over the last several years has created a cadre of utilities with the experience and resources to operate nuclear units efficiently and effectively, and the ability of undertaking construction of new baseload electrical capacity in time to meet national needs.

After decades without any orders for new nuclear power plants in the United States, U.S. utilities are demonstrating a renewed interest in this technology. The factors that came together in the 1970's to make nuclear power less attractive than other energy sources, such as an over-supply of electricity and high interest rates, are no longer applicable. Today, we are facing rapidly rising natural gas prices, increasing reliance on imported oil supplies, and growing concerns about air pollution.

As a result of this changing environment, in March, nuclear industry representatives indicated that one or more U.S. utilities were on the verge of filing applications for approval of sites for potential construction of nuclear power plants. Following NRC approval of these applications, the utilities could return to the NRC at a later date to ask for a combined construction and operating license (COL) for a pre-approved nuclear power plant design. We are pleased with these recent developments since the Department has worked long and hard as a partner with the industry to achieve these milestones and is continuing to support demonstration of the NRC early site permit and COL processes. In addition, utilities are beginning to look at new nuclear power plant designs that may be attractive in the current market. For example, Exelon Corporation has invested in the Pebble Bed Modular Reactor (PBMR) project currently under development in South Africa with the goal of exploring its feasibility for the U.S. market. The DOE Nuclear Energy office is leading discussions with the NRC on requirements for gas-cooled reactors such as the PBMR and the Gas Turbine Modular Helium Reactor (GT-MHR). Further, interest in advanced light water reactor technologies such as the AP-600/1000 and Advanced Boiling Water Reactor remains high among U.S. utility decision-makers.

With interest in building new nuclear power plants higher today than at any point in three decades, the Department is focusing its efforts to assure that Government is an appropriate partner to industry and not an obstacle. We are focusing on removing unnecessary barriers and leading the development of new technologies. In this way, the Department can best support the national need for clean and economic supplies of electric power for the near and long term.

The Office of Nuclear Energy is also pursuing advances in nuclear medical technologies through our Medical Isotope Program. This program promotes vital U.S. research into the use of isotopes to treat and diagnose cancer and other illnesses. Radioisotope therapy has the potential to become standard medical treatment for a number of cancers that are major causes of death in the United States, including breast, prostate, and bone cancer. Our budget request for the Medical Isotope Program will support advanced research and assure that reliable supplies of these life-saving therapeutic and diagnostic isotopes will be available. Human trials of new isotope-based treatments often require the administration of multiple doses of radioisotopes over a period of time, and disruptions in supply may spell the difference between life and death for critically ill patients.

Many of the most important radioisotopes have short half lives and cannot be stockpiled against

vagaries in facility operation. The importance of a reliable supply of radioisotopes was driven home for us last summer when the Cerro Grande fire temporarily shut down operations at Los Alamos and threatened the security of our facilities there. The need for reliability of supply requires that we maintain, and upgrade as necessary, the facilities at which radioisotopes are produced, and our efforts this year include upgrading a facility to help ensure that availability.

The Department also has an essential role in enabling the United States to explore space. Our Advanced Radioisotope Power Systems program provides critical support to our nation's efforts to better understand the universe in which we live. NASA's space exploration program requires reliable, long-term supplies of electricity and heat to power spacecraft and to maintain a suitable environment for people and equipment. For some missions, particularly long-term, deep space missions, radioisotope power systems are the only possible sources of power. Conventional sources of energy would require too much fuel, and solar power simply will not work for missions that extend to the outer portions of the solar system and beyond. The same types of systems that support space exploration are also used for national security missions of the Department of Defense (DOD). Our role, for both NASA and DOD, is to provide the radioisotope power systems that meet their mission needs. This requires that we maintain a sufficient supply of plutonium-238 to meet the schedules and energy demands of upcoming missions of both agencies, as well as the infrastructure to build and deliver the needed systems on time. We also support research and development on advanced systems to assure that we can meet future needs, which may call for longer operating times and higher powers. Our research is also driven by the current limitations in the supply of plutonium-238; we are simultaneously working on options for additional supplies. NASA and DOD provide funding for mission-related activities, while DOE is charged with maintaining the infrastructure to meet the NASA and DOD needs.

Finally, I want to bring to your attention another important function of the Office of Nuclear Energy: the support of the infrastructure that makes all these efforts -- development of new reactors to meet future energy needs, production of life-saving isotopes, and support of space exploration -- possible. By infrastructure, I mean not only the hardware, but also the people, and not only the government facilities, but also the other facilities that support critical training needs. To these ends, the Office of Nuclear Energy both supports operations at the remaining reactors and related facilities at our national laboratories and provides a variety of types of support to the academic infrastructure that supports the training of future scientists and engineers. Regarding the national laboratory facilities, one problem we are facing is that we are operating an aging infrastructure, and continued operation of these important facilities requires not only the normal operating expenses, but also significant expenditures to maintain aging structures and to bring facilities into compliance with modern standards of electrical and fire safety. The university reactor infrastructure, which is used for DOE and NRC sponsored research, is also at risk. With tightening university operating budgets, some universities are very near to shutting down some of the most important university reactor facilities. This will impact ongoing DOE and NRC research. We are working with the universities to identify ways to prevent such shutdowns, and have chartered a special subcommittee of our advisory committee, the Nuclear Energy Research Advisory Committee (NERAC) that will be presenting its recommendations at the end of April. In the meantime, we are trying to assure that the funding we provide for reactor upgrades and other reactor support is as effective as possible in meeting critical, near-term needs. We are also continuing to support students

and faculty at the universities to the extent possible through scholarships, fellowships and research funding, and have been heartened this year to note an apparent reversal of the previous declining trend in enrollments in nuclear engineering departments. We believe this to be a result of both our sustained, though modest, support for the academic community, and of the new level of excitement about a future for nuclear power.

In accomplishing its program mission, the Office of Nuclear Energy, Science and Technology will engage research institutions in industry, U.S. universities, national laboratories, international organizations, and other countries in cooperative and collaborative efforts. The major program elements that contribute to the mission are: Advanced Radioisotope Power Systems, Medical Isotope Program, University Reactor Fuel Assistance and Support, Research and Development (includes Nuclear Energy Plant Optimization, Nuclear Energy Research Initiative, Nuclear Energy Technologies), Infrastructure (includes Test Reactor Area Landlord, Fast Flux Test Facility, and Argonne National Laboratory-West), Nuclear Facilities Management, and Program Direction.

The following table summarizes the FY 2002 request for Nuclear Energy programs:

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## NUCLEAR ENERGY FISCAL YEAR 2002 BUDGET REQUEST

(\$ in Thousands)

<u>Program Element</u>	<u>Request</u>
<b>Energy Supply</b>	
Advanced Radioisotope Power Systems . . . . .	29,094
Medical Isotope Program . . . . .	18,177
University Reactor Fuel Assistance and Support . . . . .	11,974
Research & Development . . . . .	27,079
Infrastructure . . . . .	81,279
Nuclear Facilities Management . . . . .	30,457
Program Direction . . . . .	<u>25,062</u>
<b>Total, Energy Supply . . . . .</b>	<b>223,122</b>

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## RESEARCH AND DEVELOPMENT *Accelerating Technology Innovation*

I would now like to discuss in more detail the drivers for nuclear energy research, how we have structured and improved our processes for conducting research, our major accomplishments, and how our fiscal year 2002 budget request helps position the Nation to take full advantage of exciting new developments in nuclear technology.

Over the past several years, we have reinvented the Federal role in nuclear energy research and development. Recognizing the realities of today's fiscally constrained environment, we have reorganized how we conduct research to focus on accelerating innovation and assuring the best return on the investment for the Nation. We have returned to a more focused Federal role in conducting R&D-- that is, investing most of our research portfolio on long-term, higher risk basic research aimed at reducing or eliminating significant barriers to future use of nuclear energy. This is research that typically is not within the shorter-term planning horizon of industry. Our R&D programs are designed to promote innovation and breakthrough technologies while limiting both the rate and duration of Federal investment -- making good decisions on when to expand research that is promising, when to hand off successful projects to the private sector, and when to terminate projects that fall short.

The Department obtains advice on the direction of its nuclear energy R&D activities from the NERAC. NERAC, a formal Federal advisory committee, provides expert advice on long-range plans, priorities and strategies for the nuclear technology R&D and research infrastructure activities of our office. NERAC has several active subcommittees examining various aspects of nuclear technology R&D. Reports issued by these subcommittees that address the future of nuclear energy include the *Long-Term Nuclear Technology Research and Development Plan*, to guide nuclear energy research out to the year 2020, and the *Nuclear Science and Technology Infrastructure Roadmap*. NERAC is also providing expert advice to help guide development of the Generation IV Technology Roadmap. In addition, NERAC provides recommendations regarding government-industry cooperative research in support of the Nation's 103 operating nuclear power plants.

As I think most of us would agree, in order for nuclear energy to expand in the long-term, we must successfully deal with issues such as plant economics, waste, and proliferation. For example, in the longer term, by changing the way we design and manage commercial nuclear fuel, we may be able to address proliferation concerns, making it more difficult to use nuclear power systems to advance nuclear weapons programs. Technology may be able to reduce or even eliminate the production of plutonium in spent fuel. By exploring such advanced technologies as modular reactors with long-life cores and thorium-based fuel cycles, we may find technology-based solutions to one of nuclear power's most significant long-term challenges.

The Long-Term R&D Plan, developed by NERAC with significant input from the wider research community, recommends that R&D budget levels be increased in order to enable the Nation to realize further value from our currently operating nuclear plants; provide for economic technologies and approaches to build improved advanced reactors in the United States; complete a design for a Generation IV nuclear energy system; and support a range of enduring missions within the Department. NERAC has established a goal of conducting \$240 million in nuclear energy research by 2005.

The Department initiated the Generation IV Nuclear Energy Systems Project in January 2000 by convening a meeting of senior policy officials from interested countries. Representatives of nine countries participated in this initial discussion and considered the long-term interest of the countries in the application of nuclear energy, the international interest in advanced nuclear technologies, the barriers that might prevent the future expansion of nuclear energy, and the interest of the representatives in exploring potential multilateral research projects to explore and develop new technologies. These representatives agreed to a *Joint Statement* regarding the importance of the nuclear energy option to the future and informally committed to a process to explore further cooperative activities.

As a result of this meeting, and subsequent meetings, the nine nations that first came together in January 2000 are planning the formal creation of a Generation IV International Forum (GIF) to pursue multilateral coordination and cooperation with the goal of identifying and developing Generation IV technologies that could address the factors impacting the expansion of nuclear energy internationally: economic competitiveness of building and operating nuclear energy systems; remaining concerns regarding nuclear safety and proliferation; and the challenge of minimizing and dealing successfully with nuclear wastes.

Our research and development initiatives remain the cornerstone of the Department's nuclear energy, science and technology program. These initiatives are undertaken on the basis that nuclear science and technology will continue to provide important technological benefits and advancements for the Nation in the 21<sup>st</sup> century.

The Nuclear Energy Research Initiative (NERI), a competitive, peer-reviewed research and development selection process to fund researcher-initiated R&D proposals from universities, national laboratories, and industry, has reinvigorated the Nation's nuclear energy R&D organizations. Focused on research to address the potential long-term barriers to expanded use of nuclear power -- economics, safety, proliferation resistance, and waste minimization -- the NERI program is yielding innovative scientific and engineering R&D in nuclear fission and reactor technology. Initiated in FY 1999, this program signaled the return of the United States to nuclear R&D, but a return that reflected important lessons learned and a new appreciation for harnessing outside expertise to focus the research. NERI has, despite its limited funding, gone a long way to reinvigorate nuclear R&D in this country.

The goals of NERI are to develop revolutionary advanced concepts and scientific breakthroughs in nuclear fission and reactor technology to: address scientific and technical barriers to the long-term use of nuclear energy; advance the state of nuclear technology to maintain a competitive position in overseas and future domestic markets; and promote and maintain the nuclear science and engineering infrastructure to meet future technical challenges. The program is managed to promote collaboration between U.S. research institutions and information exchange with international organizations. In FY 2001, the Department launched an international version of NERI, the International Nuclear Energy Research Initiative (I-NERI), to sponsor innovative scientific and engineering research and development conducted by joint teams of U.S. and foreign researchers. Established as a cost-shared R&D program, the program objectives of the I-NERI program are to: promote bilateral and

multilateral collaboration with international agencies and research organizations to improve the development of nuclear energy; and promote and maintain the U.S. nuclear science and engineering infrastructure to meet future technical challenges.

We are in the final stages of signing I-NERI agreements with France and South Korea. We are negotiating agreements with Japan and South Africa, which we hope to conclude this year. We also expect to conclude I-NERI agreements with the Nuclear Energy Agency of the Organization for Economic Cooperation and Development and with Euratom. When implemented, these agreements will magnify modest U.S. investments in R&D with great benefit to both the United States and our research partners. In addition to accelerating innovation and leveraging costs, I-NERI provides to the United States and the Department a key seat at the table in international policy discussions on the future direction of nuclear energy.

Our request of \$18.1 million for NERI in FY 2002 will allow continuation of the NERI and I-NERI research projects currently underway. The FY 2002 request, however, reflects the Department's decision not to initiate new energy research activities until the Vice President's Task Force issues its national energy policy recommendations; therefore, no funding is being sought in FY 2002 budget request for new research projects. During FY 2002, the Department will complete 43 NERI research projects awarded in FY 1999, and continue the 10 NERI research projects awarded in FY 2000 and the 15 NERI projects expected to be awarded in FY 2001. In FY 2002, the Department will continue the bilateral international projects initiated in FY 2001.

The Nuclear Energy Plant Optimization (NEPO) program plays a vital role in ensuring that current nuclear plants can continue to deliver reliable and economic energy supplies up to and beyond their initial 40-year license period by resolving open issues related to plant aging, and by applying new technologies to improve plant economics, reliability, and availability. The NEPO program is cost-shared with industry through the Electric Power Research Institute (EPRI) and is conducted in close cooperation with the NRC. The research conducted under the NEPO program is identified, prioritized, and selected with broad input from utilities, national laboratories, NERAC, and other stakeholders. With about a dozen projects underway, this program demonstrates the Department's ability to lead without massive funding: about 60 percent of NEPO funding is provided by industry and the suite of projects focuses on areas that industry would not have pursued on its own—projects that look at the long-term and focus on the need for a stable, reliable, non-polluting electricity source for the United States. We are requesting \$4.5 million in FY 2002 for NEPO research to improve existing plant operations, safety and reliability.

In FY 2002, our NEPO program will sponsor several high-priority research projects, based on the critical R&D needs identified in the *Joint DOE-Electric Power Research Institute Strategic R&D Plan to Optimize U.S. Nuclear Power Plants*. This comprehensive strategic R&D plan, developed jointly by the Department, industry, and a subcommittee of NERAC, includes near-term R&D that industry is doing on its own; long-term R&D in which the Federal investment is leveraged with industry to apply the unique infrastructure or expertise of DOE; and R&D that is needed to accelerate solutions to generic technical problems affecting existing nuclear power plants. The research projects conducted in the NEPO program address technical issues associated with a range of topics, including materials fatigue, fuel performance, component inspections, in-service inspections and testing, stress corrosion, and digital instrumentation and control.

New in FY 2001, the Nuclear Energy Technologies (NET) program is enabling the Department to begin to work on the development of the next generation of advanced reactor technologies. We are currently developing a Generation IV Technology Roadmap to evaluate a variety of advanced nuclear energy system concepts using rigorous technology goals developed by NERAC and the international community and to define the needed research activities for the most promising concepts. The Generation IV goals include the ability of the designs to successfully compete in all markets with the most cost-efficient electricity production technologies available while further enhancing nuclear safety, minimizing the nuclear waste burden, and further reducing risk of proliferation.

The Generation IV Technology Roadmap project is drawing on a wide array of researchers, designers, and operators from industry, academia, the national laboratories, and the international community. Together, approximately 150 senior, experienced engineers and scientists from at least 10 countries will work together to create the Generation IV Technology Roadmap. We have found that U.S. leadership has been essential to this process and that without the Department's initiative, this type of effort would not have been possible. Moreover, our leadership in this area has proven to be a very important element in achieving our overall foreign policy and national security objectives. The Generation IV Technology Roadmap will also provide additional detail and focus to the Department's long-term R&D plan for nuclear technology. The FY 2002 budget request of \$4.5 million includes funding to complete the roadmap, which will be submitted to Congress by fall 2002.

Finally, in FY 2001, the Department initiated the Advanced Accelerator Applications (AAA) program to pursue research and development on an accelerator technology with the potential to significantly reduce the radioactive toxicity and volume of civilian spent nuclear fuel, as well as to produce electricity to help offset the life cycle costs of the program. As part of this effort, the Department established a new "AAA University Fellowship" program and plans to award ten fellowships to support Masters Degree studies in areas related to the AAA program. Awards are planned to be given out within the next 60 days. As required by the FY 2001 Energy and Water Appropriations legislation, the Department has prepared a ten-year program plan for management and execution of the AAA program, exploring the potential of this new type of research facility to meet U.S. needs in the 21st Century. However, for FY 2002, the Department has requested no new funds for the AAA program.

The Administration is reviewing U.S. energy policy and related research priorities. Until these priorities are clearly identified, the Department will not request funding for major new energy initiatives.

## **UNIVERSITY REACTOR FUEL ASSISTANCE AND SUPPORT**

### ***Investments in Education***

Government, industry, and academia face similar challenges today as we seek to preserve the aging but highly developed science and technology infrastructure that the United States has developed over the last 50 years. This infrastructure is vital to delivering current and future mission-critical technologies and products to the nation. Similarly, preserving the human and research facility infrastructure at our universities and colleges remains key to preparing tomorrow's nuclear scientists and engineers. More trained personnel will be required to ensure an adequate knowledge base to support innovation and technological advancement.

The University Reactor Fuel Assistance and Support program carries out the Department's commitment to maintain U.S. leadership in nuclear research and education. For FY 2002, we are requesting \$12 million in total for this program, an amount equivalent to previous years. By supporting the operation and upgrade of university research reactors, providing fellowships and scholarships to outstanding students, and providing Nuclear Engineering Education Research Grants, the program helps maintain domestic capabilities to conduct research. The program also helps to maintain the critical infrastructure necessary to attract, educate and train the next generation of scientists and engineers with expertise in nuclear energy technologies.

Our efforts to attract students to nuclear engineering careers continue to be a major focus of our education support programs. NE's Nuclear Engineering Fellowship and Scholarship Program provides fellowships and scholarships to students enrolled in nuclear science and engineering programs at U.S. universities. This activity also pairs minority-serving institutions with nuclear engineering degree-granting institutions with the aim of increasing the number of minority students entering the field of nuclear engineering, while simultaneously strengthening the infrastructure of nuclear engineering education. In FY 2001, we expect to fund three minority/majority partnerships, and plan to increase the number to six partnerships in FY 2002.

In FY 2001, and proposed in FY 2002, the Department will provide 18 or more grants under the DOE-Utility Matching Grants Program to support education, training and innovative research at participating universities, in 50-50 cost-shared partnership with industry. We provide grants of up to \$60,000 to each participating university. We also expect to award up to 50 scholarships and 24 fellowships this year and next. The FY 2002 request also supports the Nuclear Engineering Education Research (NEER) program to stimulate innovative research at U.S. universities, at a level of \$5.0 million. This investigator-initiated, peer-reviewed research program is vital to attracting and retaining faculty and students in nuclear engineering programs. This year, with well over 100 proposals received

from universities, we will award 19 NEER grants and, with continuation of existing grants, increase the total number of research projects underway to 50.

In FY 2002, Nuclear Energy will continue a program to support nuclear engineering education by teaming with a professional society with expertise in nuclear science and technology to provide information to high school teachers and students. This program will help ensure a highly informed group of students are available to enter university nuclear engineering programs and related scientific courses of study. We also will make new radiochemistry awards for the first time since FY 1999. The three-year awards provide faculty support and student fellowships to help educate a new generation of radiochemists to address the technical challenges associated with radioactive wastes and contaminated sites.

University research reactors in the U.S. form a vital component of the nuclear science and technology and education infrastructure in this country. These facilities are an important source of neutrons supporting research that is critical to national priorities such as health care, materials science, environmental protection, food irradiation, and energy technology. Currently, there are 29 operating research reactors at 27 campuses in 20 states. However, many U.S. universities are currently considering the future of their reactors and some are contemplating the closure of their research reactor facilities. The Department is concerned about these developments, as is the NRC.

In response to this situation, the Department has asked NERAC to establish a special task force to recommend the most appropriate action for assuring that university-based facilities vital to our national infrastructure remain in operation. The task force has been conducting an intensive review and will report its findings and recommendations later this month.

This year, and proposed in FY 2002, we will continue to supply fresh fuel to and transport spent fuel from university research reactors and to fund reactor equipment upgrades. Also, under the reactor sharing initiative, this year, and proposed in FY 2002, we will continue to pair 23 institutions with research reactors to those institutions without research reactors to increase their opportunities for training, education and research in nuclear science and technology.

## **ADVANCED RADIOISOTOPE POWER SYSTEMS**

### ***Enabling Space Exploration and Discovery***

When the astronauts first walked on the moon over 30 years ago, they placed radioisotope power systems on the surface to power through the long lunar night the experiment packages they left on the surface. The images of the outer planets Neptune and Jupiter that have thrilled the general public were made possible by the radioisotope power systems that powered these scientific spacecraft. Future exploration of the outer planets and their moons will continue to require nuclear power systems as scientists search to find answers on the origins of our solar system and even of how life began. Long

time robotic exploration of Mars to pursue the potential of finding water or past life forms and eventual human exploration will also be made possible by radioisotope power systems and eventually by space reactors.

The Advanced Radioisotope Power Systems program is our Nation's only program for providing the capability to develop and build advanced nuclear power systems for deep space exploration and national security applications. The program supports and funds DOE activities related to sustaining the unique infrastructure that allows the Department to develop, demonstrate, test, and deliver power systems to the National Aeronautics and Space Administration (NASA) and other Federal agencies. In FY 2002, the Department is requesting \$29.1 million for this program, which is the minimum amount required to sustain the basic capability.

Critical national security activities and NASA missions to explore deep space and the surfaces of planets could not occur without these systems. To date, DOE has provided over 40 radioisotope power systems and heater units for use on a total of 26 spacecraft. Previous NASA missions that have used DOE-built power systems include the Apollo lunar scientific packages, Pioneer, Viking, Voyager, Galileo, Ulysses, Mars Pathfinder, and Cassini. As we consider the American enterprise in space in the first decades of this new century, it is clear that DOE's advanced power technology will continue to be indispensable if we are to continue our exploration and advance human understanding of the universe. Clearly, there will be future missions and there will be a need for these systems.

In supporting these missions, consideration is being given during FY 2002 to both a Small Radioisotope Thermoelectric Generator and a new, more efficient, Stirling engine conversion technology. The Stirling technology would require a lesser amount of plutonium-238, the heat-producing isotope that is used for all radioisotope power systems. Efforts will also proceed in support of providing Radioisotope Heater Units for two Mars Lander missions in 2003. This effort includes safety and environmental analyses to support both NASA's environmental documentation and the Department's preparation of Safety Analysis Reports, which are required to seek launch approval.

The expanding needs of our Nation's national security missions will require delivery of several radioisotope power systems over the next decade. We are currently developing a new, more efficient thermoelectric generator for these national security applications. In FY 2002, we will continue testing the thermoelectric element, proceed with design, and initiate fabrication of an engineering unit of this new generator.

For the Department to be able to continue to support these important uses of radioisotope power systems, there must be an adequate supply of the radioisotope plutonium-238 that is the heat producing isotope upon which these systems are based. There is a finite U.S. supply of this isotope and the existing U.S. capability to produce the isotope is being shut down. Because of the projected long term need for this isotope to support future space missions, the Department evaluated the option of reestablishing a domestic production capability as part of a Programmatic Environmental Impact

Statement (PEIS) on the Department's nuclear Infrastructure. The Record of Decision on this PEIS included a decision by former Secretary Richardson to reestablish this domestic capability. Funding for the initial planning for this capability is included in the FY 2002 request.

The Department is also trying to position itself so that it can support future space exploration that will require higher power levels than can realistically be provided by radioisotope power systems -- this requirement leads to the need for some type of space fission reactor. A space-based reactor will have to meet stringent requirements for reliability, size and weight. Therefore an assessment of potential space fission reactor technologies and concepts that could meet such requirements is a necessary first step in a space reactor program. Such an effort was begun in FY 2001 will continue in FY 2002 at a modest level. The assessment will focus on refining selected concepts and on evaluating programmatic factors such as cost, safety and schedule that would be associated with their potential development and delivery. NASA is an integral partner in this assessment and has provided the preliminary requirements upon which the assessments are based.

### **MEDICAL ISOTOPE PROGRAM**

#### ***Harnessing Nuclear Technology to Save Lives***

Medical isotopes save lives and reduce health care costs. Furthermore, accurate nuclear medicine diagnoses can enable physicians and patients to precisely target therapies, thus, in many cases, avoiding surgery or other debilitating treatments. The vast majority of these procedures use technetium-99m, an isotope first developed for medical applications in the 1960s at the Department's Brookhaven National Laboratory. Today, ground-breaking human clinical trials at Memorial Sloan Kettering Cancer Center are demonstrating that alpha-particle-emitting isotopes being produced at the Oak Ridge National Laboratory may be extremely effective in treating Acute Myelogenous Leukemia. Alpha-emitting isotopes work well when targeted to cancers because they provide high-intensity radiation over an extremely short distance. Thus, the cancer cells are destroyed with very little damage to surrounding tissues.

The Medical Isotope Program takes advantage of the Department's unique infrastructure, including DOE's research reactors and particle accelerators, to provide a reliable supply of stable and radioactive isotopes used in medicine, industry and research. Support of research applications that use isotopes is the Medical Isotope Program's primary focus. The program achieves this by providing peer-reviewed grants for medical research and education through the Advanced Nuclear Medicine Initiative (ANMI), by producing the low-volume, high-cost "boutique" isotopes that are needed for research, and by maintaining the unique Department of Energy infrastructure that is needed to produce isotopes.

The Department's FY 2002 request for the Medical Isotope Program is \$18.2 million. In FY 2002, the Department will continue its emphasis on isotope-based research by applying \$2.5 million to the

Advanced Nuclear Medicine Initiative, a program that applies the Department's unique expertise to advance the state of U.S. medical research, diagnosis and treatment. We believe that, as in the example of alpha isotopes, advanced isotope-based therapies may hold the key to creating safe and efficient treatments for many types of cancer. The isotope program provides isotopes to researchers across the country and remains indispensable to the conduct of advanced research in the United States where isotopes are needed. In addition, the ANMI supports the development of science and technology programs at U.S. universities and colleges to address the critical need to train experts in fields relevant to nuclear medicine such as radiochemistry and radiopharmaceuticals.

The ANMI uses a peer-review process in which members of the NERAC and other prominent experts judge the scientific merits of projects proposed by universities, hospitals, and the national laboratories for funding. I am pleased with the results to date. In September, 2000, nine research grants were made. Recipients of these grants include the Garden State Cancer Center, Oak Ridge National Laboratory, Regents of the University of Michigan, University of Chicago, University of California Davis, University of Washington, Westinghouse Electric Company LLC, and two awards to the Curators of the University of Missouri. Five educational grants to support nuclear medicine disciplines at universities and colleges were made in March 2001 to Washington University, Purdue University, University of New Mexico Health Sciences, Regents of the University of Wisconsin System, and Washington State University. With the \$2.5 million requested in FY 2002, we propose to continue the research projects and assistance to students provided this year.

A total of \$11.0 million will go toward maintaining core personnel and operating capabilities at the four Isotope Production and Distribution sites, and \$250,000 toward improving the quality of isotope products and production processes. The FY 2002 program will continue to serve its customers through the production and distribution of stable and radioactive isotopes necessary for medical, industrial, and research purposes. The Department is continuing its effort to exit commercial markets and to encourage new isotope production ventures by selling or leasing its facilities to the private sector, where possible.

However, we must reinvest in the production of isotopes to support the Nation's researchers. One of our most important projects in this area is the construction of an Isotope Production Facility (IPF) at Los Alamos National Laboratory which will maintain the Government's ability to produce short-lived isotopes required for some of the most important medical research underway in the United States.

During the past year, we became aware of some issues arising in the project to construct the IPF. Changes in the operating schedule of the LANSCE accelerator at the laboratory, increased costs for design and construction, and other issues were uncovered during reviews last year. We convened a special expert review to assess the situation and make recommendations about the continuation of the program. The primary charge to the review committee was to evaluate the IPF project team's revised cost and schedule estimate for completeness and credibility by analyzing the following: technical progress relative to the scientific requirements for the instrument; completeness of the scope; proposed

budget, cost and schedule profile, including the commitment of funds and personnel and its adequacy to complete the project on schedule and within budget; proposed budget, cost and schedule profile for the instrumentation and controls on the new accelerator beam line and target handling system; whether the contingency is adequate for the project at this stage of its development; adequacy of management structures, including the relationships to the LANSCE mission organization, to deliver the IPF within specifications and budget and on time; and proposed budget, cost and schedule profile for the development, review and approval of the safety basis documentation and performance of the required readiness review.

With the help of this review, we have established a new, high-confidence bottom-up cost estimate of the remaining work. Our request of \$2.494 million for the IPF in FY 2002 is being submitted to enable the project to be completed in September 2003.

The Office of Nuclear Energy, Science and Technology is disappointed that these problems have occurred. In response to the problems that have developed in this project, oversight of the project will be strengthened by establishing an expert project review capability at the site which will report directly to the Office of Nuclear Energy, Science and Technology. We also plan to issue a competitive procurement for a separate subcontract to complete portions of the work on the IPF instrumentation and control system, an area where the current contractor's initial estimate proved to be extremely problematic. The current project request incorporates corrections to reflect actual costs and revised estimates deemed necessary to complete the project successfully.

Another key initiative of the Medical Isotope Program is the processing and extraction of alpha-emitting isotopes from residual uranium materials stored at the Oak Ridge National Laboratory. Researchers throughout the United States are assessing alpha-emitting radioisotopes that can destroy cancer cells and reduce tumors. Alpha-emitters such as Bismuth-213 have been demonstrated to be successful for cancer therapy. In an effort to meet increased demand to support human clinical trials, the Department is expanding its processing to achieve a 30 percent increase in supply over the next year. For the long term, the Department plans to double the supply of Bismuth-213 by 2002. However, this will require installation of a new processing line at ORNL. As additional supply is made available, researchers will increase human clinical trials and develop treatments for other serious cancers including cancer of the pancreas, kidneys and other organs.

Finally, as you know, this program operates under a revolving fund as established by the FY 1990 Energy and Water Development Appropriations Act (P.L. 101-101), maintaining its financial viability with Congressional appropriations and revenues from the sales of isotopes and services. The last few years' efforts to privatize production and distribution of commercially viable isotopes, though successful, have placed additional pressure on the program's working capital. Commercial revenues, which contribute to the infrastructure fixed costs, are no longer available and, as a result, we are unable to invest in maintenance and upgrades needed for our infrastructure -- an infrastructure which is vital to providing isotopes to our research customers.

To that end, the Department will have to make capital investments in new, replaced, or enhanced processing equipment and infrastructure to improve production and processing of isotopes to meet current and anticipated future increases in demand.

## **INFRASTRUCTURE/NUCLEAR FACILITIES MANAGEMENT**

### ***Managing Federal Nuclear Facilities and Materials***

The Office of Nuclear Energy, Science and Technology also is responsible for facilities and materials associated with current and past missions of the Office. In this capacity, NE serves as landlord at Argonne National Laboratory-West and the Idaho National Engineering and Environmental Laboratory's Test Reactor Area (TRA), both of which are in Idaho. Nuclear Energy is also responsible for the safe shutdown of the Fast Flux Test Facility (FFTF) in Hanford, Washington. As part of our stewardship over these facilities, we are responsible for the management and disposition, where appropriate, of nuclear materials.

The FY 2002 budget request for Nuclear Facilities Management -- \$30.5 million -- supports Experimental Breeder Reactor-II shutdown activities; the disposition of spent fuel and legacy materials; and research on, and development of, various waste disposition technologies. The activities of the Infrastructure program are focused on maintenance of the Argonne National Laboratory-West nuclear infrastructure, the TRA Landlord program, and the Fast Flux Test Facility (FFTF) shutdown and deactivation. A funding level of \$81.3 million is proposed for this program in FY 2002.

Under the Nuclear Facilities Management program, in March 2001, the Department completed the processing of the EBR-II secondary and primary sodium and the Fermi reactor sodium, in compliance with the Idaho National Engineering and Environmental Laboratory Treatment Plan, two months ahead of schedule. In FY 2002, we will complete the engineering and technical efforts supporting the deactivation of the EBR-II and directly related facilities. The deactivation of EBR-II is currently on schedule to be completed by March 2002. We are requesting \$4.2 million to complete EBR-II deactivation.

We will continue to carry out the disposition of spent fuel at ANL-West in accordance with the Record of Decision on the treatment and management of stored sodium-bonded fuel. Also, we intend to continue research that supports NRC approval of the disposal of metal and ceramic waste forms from the demonstration project in a geologic repository, and continue repackaging and removal activities for spent nuclear fuel that remains from an earlier fuel burn-up development program and is now stored by a commercial entity at ANL-West. These activities account for \$16.3 million of the FY 2002 request.

Finally, we are requesting \$10.0 million for waste disposition technology activities, including R&D of process refinements to ensure proper treatment of EBR-II fuel rods; a development and test effort on waste stream treatment process equipment of a scale suitable for inventory treatment; long-term waste

characterization tests; improvements to existing process equipment; and development of zeolite columns and other equipment refinements to reduce waste volume and improve process efficiency.

Within the Infrastructure program, the TRA Landlord program ensures reliable support for TRA activities, such as naval reactor fuel and core component testing at the Advanced Test Reactor and privatization of production of isotopes for medicine and industry. The program also funds operations, maintenance and upgrade activities for common site facilities and utilities and ensures environmental compliance at the Test Reactor Area, including identification of legacy waste and mitigation in accordance with State regulations and DOE agreements with the State of Idaho. In FY 2002, we are requesting \$8.7 million for these TRA-related activities.

The permanent deactivation of the Fast Flux Test Facility (FFTF) was directed in a Record of Decision (ROD) issued by the Department in January 2001. The FY 2002 NE budget request reflects the investment required to continue FFTF deactivation, and to reach milestones crucial to an expeditious completion of deactivation activities in subsequent fiscal years. Experience gained from the deactivation of the Experimental Breeder Reactor-II (EBR-II) is being applied to the deactivation planning and execution for the FFTF. In FY 2002, Argonne National Laboratory engineers will continue to work closely with deactivation staff at FFTF to ensure that lessons learned are imparted to the extent practicable. This engineering and analytical support is anticipated to result in efficiencies, and, in some cases, such as sodium processing, direct application of state-of-the-art technology developed specifically for deactivation purposes.

The remainder of the Infrastructure budget request is for Argonne National Laboratory-West Operations, for which we are requesting \$34.1 million in FY 2002. This funding will provide the engineering, technical, operator and technician support for maintaining the nuclear facilities at ANL-W in compliance with DOE Rules and Orders, environmental and industrial safety requirements, and good management practice. It will also support conceptual design activities for the Remote Treatment Facility project, which is needed for disposal of mixed transuranic waste stored at ANL-W. Construction on this facility is scheduled to begin in FY 2005, with operations commencing in FY 2009.

## **PROGRAM DIRECTION/ORGANIZATIONAL ISSUES**

### ***Continuing to Refocus the U.S. Nuclear R&D Program***

NE represents the Federal Government's core expertise and capability in a wide range of civilian nuclear technologies. NE is one of the most diverse organizations in the Department. It is a research and development program that crosses many fields of application, all unified by its expertise and experience in the application of nuclear science and technology. The previous sections illustrate the breadth of our efforts.

During the past year, two nuclear-related activities were moved to other offices. The FY 2001 appropriation language transferred Uranium Programs and related personnel funding from NE to the Office of Environmental Management (EM) in recognition of the fact that the bulk of activities in Uranium Programs fell closely under the areas of expertise and effort covered by EM. This change will assure that NE activities are strongly focused on research and development. Therefore, the FY 2002 budget request for NE does not seek funding for any Uranium Program activities or personnel expenses. In addition, the Department decided in FY 2001 that safeguards and security activities within the DOE complex are so important that they should be direct-funded programs rather than be funded as an indirect cost of doing business. Therefore, all of the funding included in the FY 2002 NE budget request for safeguards and security activities reflects the transfer of funds to other program offices for carrying out these activities.

In the Program Direction category for FY 2002, NE is requesting \$25.1 million for salaries, travel, support services and other administrative expenses for headquarters and field personnel providing technical direction to NE programs. Our Program Direction funding also supports the many intensive activities of the NERAC.

As part of the Department's objective to maintain a highly skilled workforce, NE must hire additional staff to replenish critical technical expertise such as that required to assure the safe operation of the Department's various reactor facilities and to carry out new responsibilities such as the Nuclear Energy Research Initiative (NERI) and the Nuclear Energy Plant Optimization (NEPO) programs. In addition, NE is faced with another issue concerning the aging workforce. The average age of NE employees is 49, and there are many employees who will soon be eligible to retire (25 percent by December 31, 2001). Over 50 percent of the current organization could turn over within just a few years. Staffing levels have reached the point where some augmentation is necessary to be able to maintain a core staff of knowledgeable, competent, and experienced scientists and engineers to meet the growing responsibilities now being placed on the Office. NE is currently recruiting several entry-level engineering and scientific positions to replace senior, experienced technical staff expected to retire in the near future.

## **CONCLUSION**

Over the last three years, the Nuclear Energy program has made great strides. We have launched three new research initiatives, and have successfully demonstrated a major technology for treatment of spent fuel. The budget we are proposing for FY 2002 would provide for more focused international collaboration and leveraging of the federal investment in nuclear energy R&D, and would sustain our enduring role in support of space exploration, would ensure the continuing supply of medical and research radioisotopes, and would provide for ongoing safe stewardship of our Federal nuclear facilities and materials.

As I said at the beginning of my testimony, we have a historic window of opportunity today to begin planning the next several decades of innovation. The decisions we collectively make today can significantly influence energy supply options and the environmental outcomes over the next 50 years. I look forward to working with you and the Subcommittee as we embark on preparing the technologies needed for this new century.

Mr. Chairman, this concludes my prepared statement. I would like to thank you and the Subcommittee members for your continuing support of the Nuclear Energy program. I will be happy to answer any questions.